(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : 0 526 202 A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number : 92306955.3

(22) Date of filing : 30.07.92

(30) Priority : 31.07.91 JP 190431/91

(43) Date of publication of application :
03.02.93 Bulletin 93/05

(84) Designated Contracting States :
DE GB SE

(51) Int. Cl.^{5} : H04L 7/00

(71) Applicant : NEC CORPORATION
7-1, Shiba 5-chome Minato-ku
Tokyo 108-01 (JP)

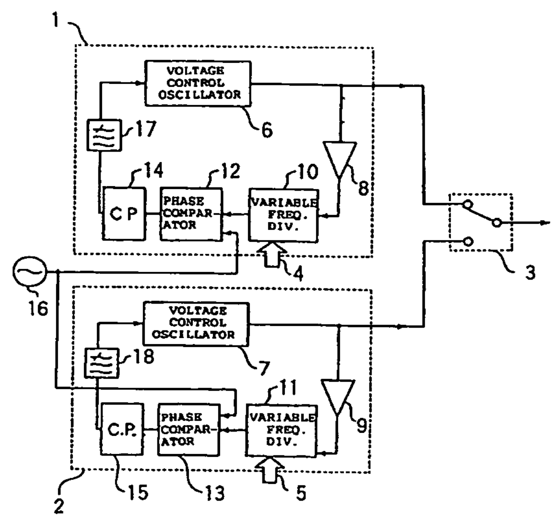
(72) Inventor : Jokura, Jun, c/o NEC Corporation
33-1, Shiba 5-chome
Minato-ku, Tokyo 108-01 (JP)

(74) Representative : Harland, Linda Jane
c/o Reddie & Grose 16 Theobalds Road
London WC1X 8PL (GB)

(54) Local oscillating frequency synthesizer for use in a TDMA system.

(57) A local oscillating frequency synthesizer for a station of a TDMA system includes a pair of synthesizers (1, 2), one being used for generating synchronizing frequencies for monitoring communication channels comprising transmission and reception slots, and the other for generating synchronizing frequencies for monitoring the electric field level of another station, when information is read out from idle slots rather than the transmission and reception slots. Therefore, without using a high speed frequency switching synthesizer such as a direct digital synthesizer or the like changes in frequency synchronization can be achieved in a short period of time by using a selector means (3) to switch between the frequency synthesizers (1, 2) and a local oscillating portion which is low in power consumption can be obtained.

F I G. 3



EP 0 526 202 A2

BACKGROUND OF THE INVENTION

The present invention relates to a TDMA (Time Division Multi-Access) system and, in particular, to a local oscillating frequency synthesizer for use in a TDMA system for monitoring idle slots.

In a local oscillating portion of a mobile communication terminal, which is used in a TDMA system as a high speed switching frequency synthesizer for, subsequent to a transmission slot and reception slots, switching the frequency to observe the electric field and BER (Bit Error Ratio) of an adjacent station, a direct digital synthesizer has conventionally been used.

Fig. 1 is block diagram showing a prior art frequency synthesizer using a direct digital synthesizer 27. The frequency synthesizer includes a PLL (Phase-Locked Loop) frequency synthesizer comprising a voltage control oscillator (VCO) 19, a buffer amplifier 20, a fixed frequency divider 21, a phase comparator 22, a charge pump (CP) 23 and a low-pass filter (LPF) 24. The frequency synthesizer further comprises a low-pass filter (LPF) 25, a D/A (Digital-to-Analog) converter 26 and a reference oscillator 28.

In the direct digital synthesizer 27, a reference frequency is digitally generated by using an oscillating frequency from the reference oscillator 28, and after passing through the D/A converter 26 and the LPF 25, it is entered to the phase comparator 22 of the PLL synthesizer. On the other hand, the output frequency of the voltage control oscillator (VCO) 19 is divided by the fixed frequency divider 21 to be entered to the phase comparator 22 where it is compared in phase with the reference frequency. The resulting error signal is converted into a voltage corresponding to the phase difference between the compared frequencies by the charge pump (C.P.) 23 and the LPF 24 to control the oscillating frequency of the voltage control oscillator 22 to generate a carrier.

Communication channel (CH) designation data 4 are entered to the direct digital synthesizer 27 to change the reference frequency. As a result, even if the channels are switched at an interval of 25 KHz, the compared frequency at the phase comparator 22 can be set high to allow a high speed frequency switching.

Fig. 2 illustrates how the slots are disposed in the TDMA system, in which it is possible to read the monitoring information on the electric field level of the other base station by utilizing an idle period 31 of time other than the reception slot 29 and the transmission slot 30. In this case, the following will become necessary: by entering channel designation data 5 of the other station to be monitored to the direct digital synthesizer 27, subsequent to the transmission and reception slots, the oscillating frequency 32 is switched to other station's channel designated by the data 5 to monitor the electric field, BER and the like on the other station's channel, and at the next transmission and reception slots, the oscillating frequency is returned to the original communication channel. To this end, the above-described high speed frequency switching technique has been used.

In such a local oscillating frequency synthesizer using the conventional direct digital synthesizer as discussed above, in order to digitally generate the reference oscillating waveform, it is necessary to use the digital frequency generating portion and the D/A converter portion, which consumes the electric power greatly.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a local oscillating frequency synthesizer comprising:

a first frequency synthesizer for synchronizing the frequencies of communication channels used for transmission and reception slots;

a second frequency synthesizer sharing a reference frequency oscillator with said first frequency synthesizer, for synchronizing the frequencies when the electric field level of a channel other than that of said communication channels is monitored and its information is to be read out of an idle slot other than said transmission and reception slots; and

a selector means for selecting one of the outputs from said first and second frequency synthesizers.

The local oscillating frequency synthesizer of the invention thus allows the elimination of the highly power consumptive digital frequency generator and D/A converter of conventional systems and so may advantageously reduce the power consumption of the synthesizer.

In a preferred embodiment of the present invention, the frequencies for the communication channels using the transmission and reception slots are synchronized for transmission and reception by means of the communication channel frequency synthesizer of variable frequency dividing system, and when the electric field level of the channel other than the communication channels is monitored and its information is read out, the idle slots other than the transmission and reception slots are used for synchronizing the frequency of the other channel by means of the frequency synthesizer dedicated to monitoring the other channel, which shares the reference frequency oscillator with the communication channel frequency synthesizer. Therefore, without using the direct digital synthesizer, a local frequency synthesizer for monitoring other station which allows the frequency to be stably and fast switched while being low in power consumption may be obtained.

A preferred embodiment of the present invention will be described in detail with reference to the accom-

panying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a synthesizer using a conventional direct digital synthesizer;

Fig. 2 is a layout plan of slots in the TDMA system; and

Fig. 3 is a block diagram of a local oscillating frequency synthesizer used in a TDMA system, which is according to a specific embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 3, there is illustrated a block diagram of a specific local oscillating frequency synthesizer embodying the present invention, which includes a first frequency synthesizer 1 used for synchronizing the frequencies of the communication channels intended for the transmission and reception slots, a second or dedicated frequency synthesizer 2 used for synchronizing the frequencies when the electric field level of other channel is monitored and information is read out of the idle slot other than the transmission and reception slots, a reference frequency oscillator 16 common to the frequency synthesizers 1 and 2 and a selecting means such as a switch 3 for selecting one of the outputs from the frequency synthesizers 1 and 2.

The first frequency synthesizer 1 for transmission and reception comprises a voltage control oscillator 6, a buffer amplifier 8, a variable frequency divider 10 for changing the frequency divider ratio according to the channel designating data 4 of the communication channel, a phase comparator 12 for comparing a reference frequency from the reference frequency oscillator 16 and the output frequency of the frequency divider 10, and a charge pump 14 and a LPF 17 for emitting a converted voltage corresponding to the resulting phase difference to change the oscillating frequency of the voltage control oscillator 6.

The second frequency synthesizer 2 dedicated to monitoring other stations comprises a voltage control oscillator 7, a buffer amplifier 9, a variable frequency divider 11 for changing the frequency dividing ratio according to the channel designating data 5 of the other station to be monitored, a phase comparator 13 for comparing in phase the reference frequency from the reference frequency oscillator 16, which is shared with the transmission/reception frequency synthesizer 1, and the output frequency of the frequency divider 11, and a charge pump 15 and a LPF 18 for emitting a voltage corresponding to the phase difference to change the frequency.

The operation of the local oscillating frequency synthesizer will be described.

In the state that the communication channel is set, with the switch 3 for switching the frequency synthesizer set at the shown position, the transmission and reception frequency are synchronized by the transmission/reception synthesizer 1. The frequency dividing ratio is changed at the variable frequency divider 10 according to the channel designating data 4 of the communication channel, and its phase is compared with that of the reference frequency supplied from the reference frequency oscillator 16 by the phase comparator 12. Therefore, the output frequency of the voltage control oscillator 6 is divided by the variable frequency divider 10 at the dividing ratio according to the channel designating data 4, and the output frequency of the synthesizer 1 is settled when the frequency of the output of the variable frequency divider 10 becomes equal to that of the reference frequency oscillator 16.

Upon reception of channel designating data from the base station, if the electric field level of the other station is monitored and its information is read out, then the switch 3 is switched to the synthesizer 2 dedicated to monitoring the other station to change the frequency dividing ratio by the variable frequency divider 11 according to the channel designating data 5 of the other station at the timing of the local oscillator for the idle slot of Fig. 2. In accordance with the operation similar to that of the transmission/reception synthesizer 1 during the idle slot, the output frequency of the frequency divider 11 is compared in phase with the reference frequency of the reference frequency oscillator 16 by the phase comparator 13 to synchronously lock the frequencies, and at the next transmission reception slot, the output of the synthesizer 2 is switched to that of the synthesizer 1 by using switch 3.

According to the embodiment as described above, since the frequency synthesizer dedicated to monitoring the other station is adopted, it becomes unnecessary to use the digital frequency generating portion, and the changing step of the voltage control oscillator can be taken small by the variable frequency dividing system. Therefore, the range can be enlarged, and the margin corresponding to a high frequency channel can also be secured to allow a high speed switching of the frequency, and the sharing of the reference frequency generator by the frequency synthesizers 1, 2 also allows a stability of the circuit operation to be assured.

Claims

1. A local oscillating frequency synthesizer for use in a TDMA system comprising:

   a first frequency synthesizer (1) for synchronizing the frequencies of the communication channels used for transmission and reception slots;

a second frequency synthesizer (2) sharing a reference frequency oscillator (16) with said first frequency synthesizer (1), for synchronizing the frequencies when the electric field level of a channel other than said communication channels is monitored and its information is read out of an idle slot other than said transmission and reception slots; and

a selector means (3) for selecting one of the outputs from said first and second frequency synthesizer.

2. The local oscillating frequency synthesizer according to claim 1 wherein said first frequency synthesizer (1) comprises a variable frequency divider (10) of which frequency dividing ratio is changed according to the channel designation data (4) of the communication channel, and a phase comparator (12) for comparing the reference frequency from said frequency divider (10) with the reference frequency from a reference frequency oscillator (16).

3. The local oscillating frequency synthesizer according to claim 1 or 2 wherein said second frequency synthesizer (2) comprises a voltage control oscillator (7), a buffer amplifier (9), a variable frequency divider (5) for changing the frequency dividing ratio according to the channel designation data (5) of the other station to be monitored, a phase comparator (13) for comparing in phase the reference frequency from said reference frequency oscillator (16) and the frequency of said voltage control oscillator (6), and a charge pump (15) and a low pass filter (18) for emitting a voltage corresponding to the phase difference to change the frequency.

4. A local frequency synthesizer for use in a station of a TDMA system comprising:

a first frequency synthesizer (1) having an output,

a second frequency synthesizer (2) having an output, and

a selector means (3) having first and second inputs, connected respectively to the outputs of the first and second synthesizers, which inputs may be selectively coupled to a selector means output which forms an output of the local frequency synthesizer.

5. A local frequency synthesizer according to claim 4, in which inputs of the first and second frequency synthesizers are coupled to a common reference frequency oscillator.

6. A local frequency synthesizer according to claim 4 or 5, in which the first and second frequency synthesizers are for generating at their respective outputs first and second synchronizing waveforms of first and second frequencies for monitoring first (29, 30) and second (31) channels of the TDMA system.

7. A local frequency synthesizer according to claim 4 or claim 5, in which the first channel is a communication channel comprising a transmission slot and a reception slot and the second channel is a channel of another station comprising an idle slot.

FIG. 1
(PRIOR ART)

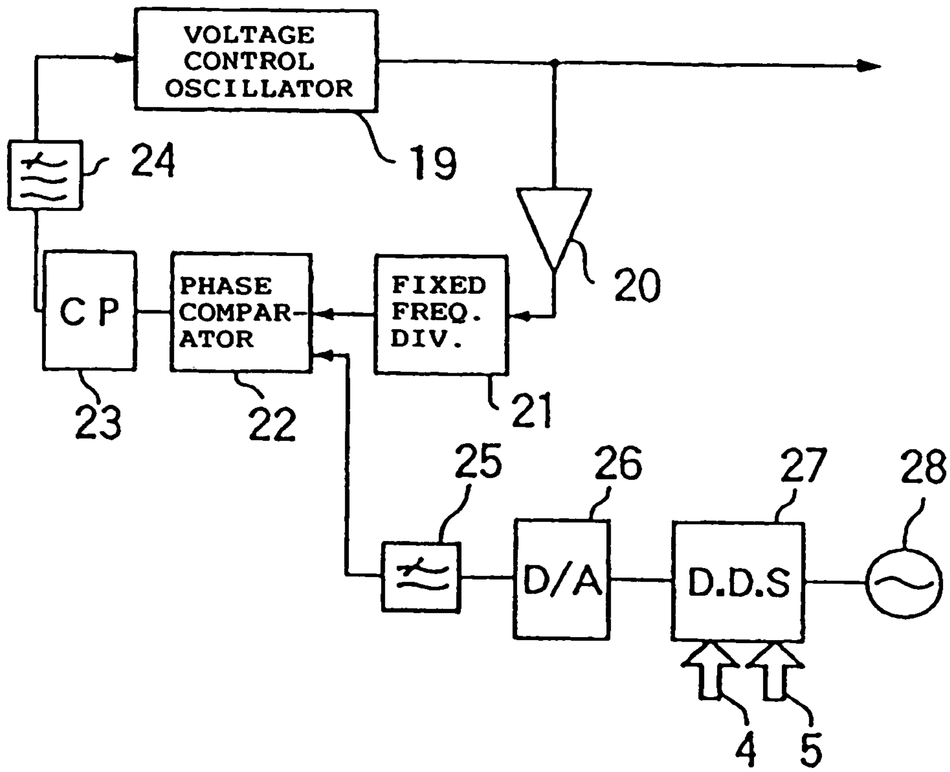
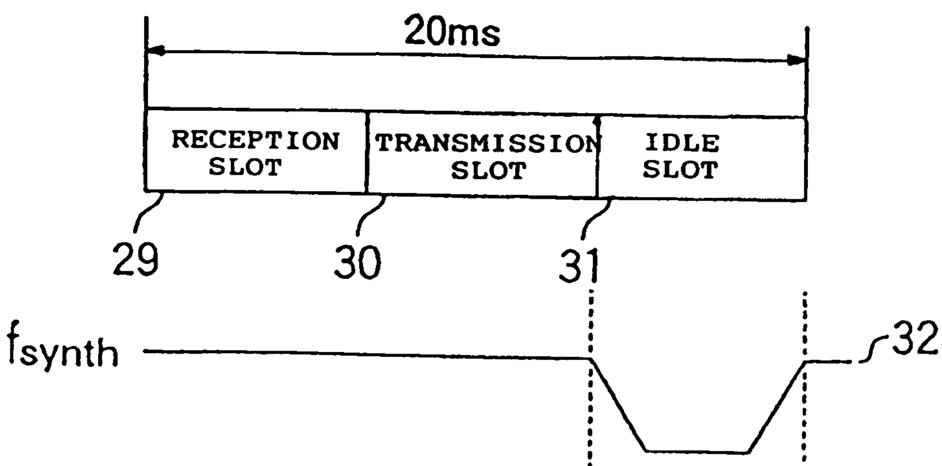
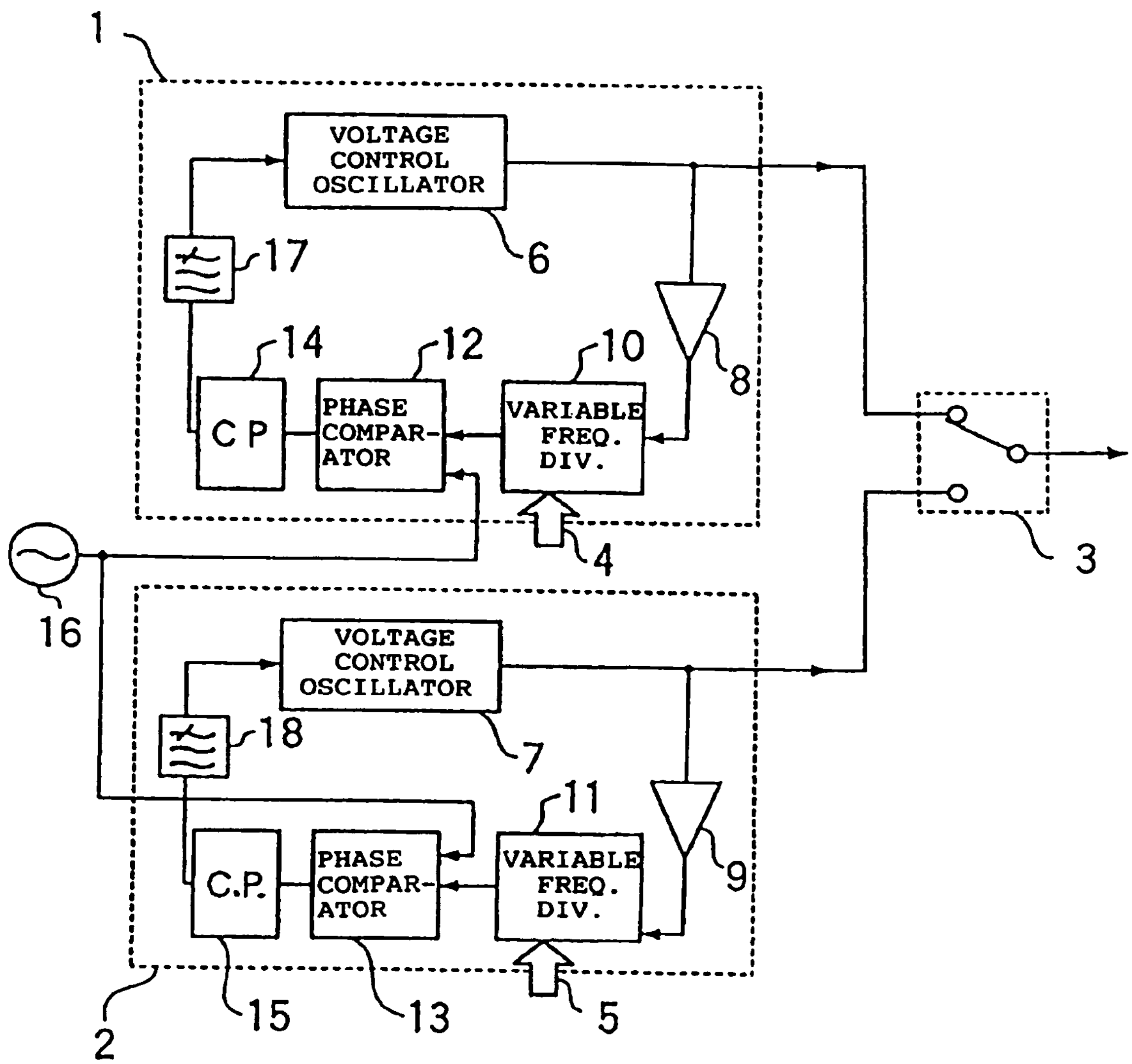


FIG. 2



F I G. 3


1
VOLTAGE CONTROL OSCILLATOR
6
17
14
12
10
8
C P
PHASE COMPAR-ATOR
VARIABLE FREQ. DIV.
4
3
16
VOLTAGE CONTROL OSCILLATOR
7
18
11
9
C.P.
PHASE COMPAR-ATOR
VARIABLE FREQ. DIV.
2
15
13
5